



mechanical energy energy due to the motion and position of an object (167)

mechanical mixture mixture in which the different substances are visible (14)

membrane technologies industrial use of synthetics to mimic the action of membranes (284)

meristem growth region of the plant with tissue in which cells divide by mitosis (299)

mesophyll specialized ground tissue inside a leaf, made up of thin-walled cells containing chloroplasts (311)

mesosphere the third atmospheric layer above Earth's surface (345)

metal shiny, malleable, ductile element (29)

metalloid element with properties intermediate between metals and non-metals (29)

microscope an instrument with a lens or system of lenses for magnifying specimens (478)

microscopist (mi-cros-co-pist) a person trained in the use of the microscope (243)

mirror sometimes used in a microscope, in the place of a lamp, to direct light from the surroundings through the diaphragm (478)

mitochondria (*sing.* mitochondrion) organelles that perform cellular respiration in a eukaryotic cell (269)

mixture combination of pure substances (14)

molar mass mass of one mole of a substance (108)

mole quantity that chemists use to measure elements and compounds; symbol: mol; Avogadro's number is the number of particles in a mole (107)

molecular element element that forms molecules made up only of its own atoms (48)

molecule group of non-metallic atoms bound together by covalent bonds; can be made up of atoms of the same element or atoms of different elements (29)

Montreal Protocol an international agreement to phase out the production and use of CFCs (421)

motion the changing in position of an object relative to a reference point; an imaginary line joining the object to the reference point changes in length and direction or both (127)

multivalent element element with more than one stable ion (44)

N

natural greenhouse effect the absorption of thermal energy by the atmosphere (365)

net radiation budget the difference between the amount of incoming radiation and outgoing radiation from Earth's surface and atmosphere (367)

neutral description of a substance that is neither acidic nor basic; solution with a pH of 7 (at 25°C) (64)

neutralization process in which acids and bases react with each other so that the H^+ ion and OH^- ion combine to make a single water molecule; both acidic and basic properties disappear (68)

neutron neutral particle in the nucleus of an atom (25)

noble gases extremely unreactive non-metals; group 18 in the periodic table (31)

non-metal one of 17 elements with varying properties that are completely different from metals (29)

non-renewable energy source energy source that is limited and cannot be replaced (222)

nuclear energy potential energy stored in the nucleus of an atom (167)

nuclear envelope a double-layer membrane that separates the nuclear contents from the cytoplasm (270)

nucleic acid complex molecule made up of nucleotides; includes DNA and RNA (271)

nucleons subatomic particles in the nucleus of the atom; protons and neutrons (25)

nucleus (in cells) organelle that contains DNA, the genetic material, and directs all cellular activities (251)

nucleus (in atoms) positively charged centre of the atom made up of protons and neutrons (23)

O

objective lens gathers light from a specimen and forms an inverted image (478)

octet rule atoms bond in such a way as to have eight electrons in the valence energy level; also called the rule of eight (38)

ocular lens allows observation of specimen and provides part of the total magnification; is the lens nearest the eye (478)

open system a system that exchanges both matter and energy with its surroundings (199)

organ group of tissues that work together to perform a specific function (297)

organelle structure that performs a specific function within a cell (266)

osmosis diffusion of water across a selectively permeable membrane (277)

outgoing radiation the thermal radiation emitted by Earth's surface and atmosphere that is not absorbed by greenhouse gases of the atmosphere (367)

ozone a molecule made up of three atoms of oxygen (345)

ozone layer a layer in the stratosphere containing high levels of ozone gas (345)

P

palisade tissue cell column-shaped mesophyll cells in a plant leaf; responsible for photosynthesis (311)

particle model a model to explain the nature of matter, based on particle composition, attraction, and movement (274)

passive transport movement of substances along the concentration gradient; transport process that does not require ATP (275)

perfect machine hypothetical machine in which all the input energy is converted completely into mechanical energy; also called perpetual motion machine (202)

period horizontal line or row in the periodic table; periods are numbered from 1 to 7 (31)

peritoneal dialysis a process by which waste products from the blood pass by diffusion into a dialysate solution in the peritoneal cavity (286)

peritoneum a membrane that lines the abdominal cavity in humans and other vertebrates (286)

permafrost permanently frozen ground (353)

perpetual motion machine hypothetical machine in which all the input energy is converted completely into mechanical energy; also called perfect machine (202)

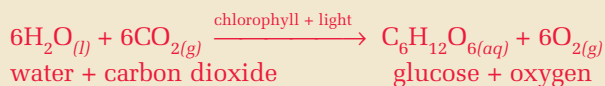
pH measure of the number of hydrogen ions in a solution; indicates how acidic or basic a substance is (62)

phase the state of a substance (solid, liquid, or vapour) (382)

phloem tissue vascular tissue that transports carbohydrates and water from the leaves to other parts of the plant (292)

phospholipid bilayer double layer of outward-facing phosphates and inward-facing fatty acids that form a cell membrane (272)

photosynthesis means putting together with light (“photo” = light; “synthesis” = putting together); a chemical process in which carbon dioxide from the air and water from the soil, in the presence of light energy, produce glucose and oxygen (82)



phototropism directional plant growth in response to light (323)

negative phototropism growth away from the light source (323)

positive phototropism growth toward the light source (323)

physical change change to a substance in which the composition of the substance stays the same (18)

physical properties properties that describe the physical appearance and composition of a substance (13)

plasma membrane structure that surrounds a cell and regulates the passage of materials between the cell and its environment; also called cell membrane (272)

plasmolysis shrinking of the cytoplasm and plasma membrane away from the cell wall due to outflow of water in a hypertonic environment; observed only in cells with rigid cell walls (320)

polar description of an object that has a positive electric charge at one end and a negative charge at the other; water molecules are slightly polar (60)



polyatomic ion charged particle made up of several non-metallic atoms joined together (44)

potential energy energy that is stored and held in readiness; energy that has the potential to do work; types of potential energy include gravitational, elastic, and chemical (173)

prairie a subtype of grassland biome found in regions such as North America; prairies have cooler average temperatures than the other subtype of grassland biome, savanna (397)

precipitate solid with low solubility that forms from a solution (15)

precipitation (in solutions) process of forming a solid from a solution (58)

pressure difference the difference in pressure in two areas that may cause movement of substances (321)

pressure-flow theory explanation of plant nutrient transport from leaves to other parts of the plant, driven by the pressure build-up of hypertonic solution in leaf phloem (321)

prions infectious particles composed of specifically altered proteins that occur in the brains of humans and animals and can lead to neurodegenerative diseases; some prions act as infectious agents in bovine spongiform encephalopathy (BSE) in cattle and in a new variant of Creutzfeldt-Jakob disease (nvCJD) in humans (262)

product new substance produced in a chemical reaction (79)

protein large molecule formed by amino acids; responsible for many structures and functions (271)

protein hormones protein molecules that are active in an organism at a distance from the location where they are produced (327)

protein synthesis assembly of amino acids into proteins in a cell, based on instructions encoded on a DNA molecule (269)

protist a single-celled organism with a nucleus; it does not belong to the plant, fungi, or animal groups (251)

proton positively charged particle in the nucleus of an atom (25)

pure substance substance in which all the particles are identical (14)

Q

quantity of thermal energy (Q) the amount of thermal energy absorbed or released when the temperature of a substance changes by a certain number of degrees; given by the equation $Q = mc\Delta t$ (378)

R

radiant energy energy that is transmitted as electromagnetic waves (167)

radiation emission of energy as particles or waves (370)

rate of diffusion the relative movement of a particle in response to a concentration gradient (275)

reactant substance that reacts in a chemical reaction to form another substance or substances (79)

reagent substance used for identifying, measuring, or producing other substances (37)

receptor proteins specialized molecules on the surface of the cell to which messenger molecules from other cells can bind; play an important role in cell-to-cell communication, particularly in the immune system (284)

recognition proteins protein molecules protruding from cells that allow communication between cells, such as in sperm-egg recognition in a species (284)

reflect change the direction of a ray of radiant energy (362)

renewable energy source energy source that is continually and infinitely available (222)

resolution or **resolving power** the ability to distinguish between two structures that are close together (255)

respiration process by which an organism secures oxygen from the air, distributes it, combines it with substances, and gives off carbon dioxide (82)

responding variable condition that changes in response to the manipulated variable in an experiment (65)

reverse osmosis (RO) the movement of water through a semi-permeable membrane from a high concentration of solute to a low concentration of solute (287)

revolving nosepiece rotating mount that holds many objective lenses (478)

ribosome organelle in cytoplasm that is the site of protein synthesis (269)

root part of a plant, usually below ground, that is involved in the absorption and transport of water and minerals and the storage of food materials (297)

root hair extension of a specialized dermal cell on a plant root, which absorbs water and minerals (301)

root pressure upward force exerted on water in the xylem in the roots of some plants (316)

root system the plant organ system that includes all tissues located below the ground (297)

S

salt compound produced in a neutralization reaction between an acid and a base (31)

salting method of drying food to preserve it; salt draws water out of the food (18)

savanna a subtype of grassland biome found in regions such as Africa, Central America, and Australia; has warmer average temperatures than the other subtype of grassland biome, prairie (397)

scalar quantity quantity that indicates magnitude only (137)

scale (of a drawing) the difference between the size of an object in a drawing or diagram and the actual size of the object. Scale is often expressed as a ratio, e.g., size on drawing:actual size (246)

scientific evidence evidence collected in a manner that, as much as possible, ensures it is unbiased and reflects general situations, rather than particular events; is usually collected by trained scientists and checked by other scientists (352)

second law of thermodynamics heat always flows naturally from a hot object to a cold object, never naturally from a cold object to a hot object (202)

selectively permeable membrane a natural membrane that allows certain particles to pass through it but excludes others (275)

semi-permeable membrane a type of membrane which allows certain particles to pass through while others are excluded; can be natural or synthetically produced for industrial use (275)

shoot system the plant organ system that includes all tissues located above ground (297)

sieve tube a tube formed by a stack of sieve tube cells to allow conduction of phloem in plants (300)

sieve tube cell cylindrical cells lacking nuclei and with perforated sides and end walls that allow the movement of phloem sap between cells (300)

single replacement reaction chemical reaction in which a reactive element reacts with an ionic compound (96)

sink according to the pressure-flow theory, cells that receive carbohydrates in plants (321)

skeleton equation formula equation showing the identity of each substance involved in a chemical reaction; does not show the correct proportions of the reactants and the products (87)

solar energy energy from the Sun; generated by a hydrogen–hydrogen nuclear fusion reaction (167)

solstice one of two points in Earth's orbit at which the poles are most tilted toward or away from the Sun (359)

solute the substance that is dissolved in a solution (275)

solution mixture in which the separate components are not visible (14)

solvent the substance that dissolves one or more solutes in a solution; water is the most common solvent (272)

source according to the pressure-flow theory, cells that manufacture carbohydrates in plants (321)

specific heat capacity (c) amount of energy required to raise the temperature of 1 g of a substance by 1°C (377)

spongy mesophyll tissue layer of loosely spaced mesophyll cells in a leaf; the increased distance between cells promotes diffusion (311)

spontaneous generation the idea that life could emerge spontaneously from non-living matter, widely held into the 19th century; disproved by Louis Pasteur (247)

stage clip clip that holds a microscope slide in place on the stage (478)

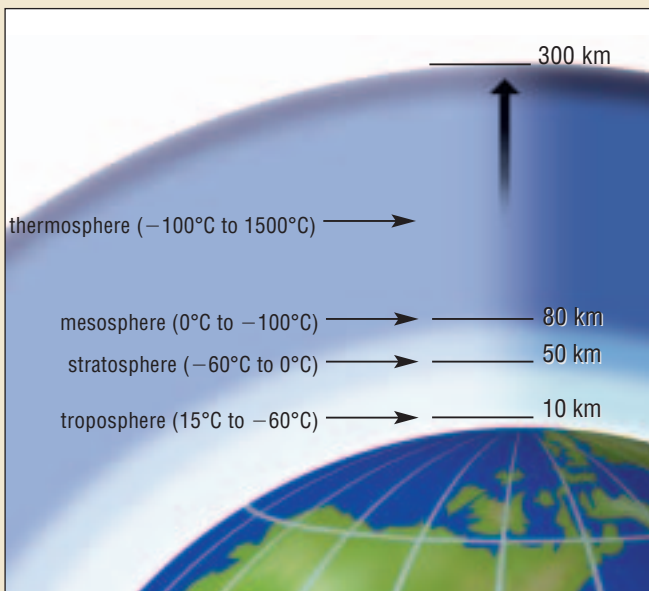
stage of microscope the part of the microscope on which the specimen slide is placed for examination; can be moved up and down for examination of the specimen (478)

staining techniques use of stains or colouring agents to improve the contrast between structures in cells; staining properties depend on the chemical composition of the structure (254)

stimulus (*pl. stimuli*) a change in the environment that causes a reaction by the organism (323)

stomata (*sing. stoma*) pores that allow gases to pass through the epidermis of a leaf (302)

stratosphere atmospheric layer above the troposphere, from 10 to 50 km above Earth's surface (345)



surface area total area of external surfaces of an object (289)

surface area to volume ratio the ratio between the total area of external surfaces of an object and its volume (289)

surroundings everything that is outside of a system (199)

suspension mechanical mixture in which the components are in different states (14)

sustainable description of any process that will not compromise the survival of living things or future generations while still providing for current energy needs (227)

sustainable development the use of the world's resources in a way that maintains the resources for future generations (227)

synthesis reaction chemical reaction in which two elements combine to form a compound; also known as a formation reaction (91)

system a set of interconnected parts; a system can be classified as open, closed, or isolated (199)

system (in animals and plants) a set of organs or parts that performs one or more functions as a unit (391)

T

tension a stress caused by the action of a pulling force (318)

thermal energy the amount of energy possessed by a substance by virtue of the kinetic energy of its molecules or atoms (357)

thermal energy transfer movement of thermal energy from an area of high temperature to an area of low temperature (370)

thermal power station electrical generating station that uses thermal energy to produce steam to drive turbines; sources of thermal energy include coal, natural gas, and nuclear energy (193)

thermodynamics study of the interrelationships between heat, work, and energy (169)

thermosphere furthest atmospheric layer from Earth's surface (345)

tissue group of similar cells that perform a specific function (297)

tonicity a term that relates the concentration of solute particles in solutions; *see also* **hypertonic**, **hypotonic**, and **isotonic** (319)

trace element element that an organism requires in small amounts (272)

transpiration loss of water from leaves through evaporation (309)

transpiration pull the tension or pull on water molecules in the xylem due to evaporation of water through the stomata or lenticels in a plant (318)

troposphere layer of atmospheric gases at 0 km to 10 km from Earth's surface (344)



tuber enlarged underground stem that stores food (297)

turgid firm; plant cells become turgid when water enters due to a hypotonic surrounding environment (268)

turgor pressure pressure exerted against a cell wall by the water that has entered the cell through osmosis (268)

U

uniform motion movement in a straight line at a constant speed (127)

United Nations Framework Convention on Climate Change (UNFCCC) an agreement by the world's nations to act in ways that will stabilize greenhouse gas emissions from anthropogenic sources (421)

universal indicator mixture of several indicators that change colour as the acidity of a solution changes (63)

useful energy output energy needed to do work (215)

useful work output work that a machine is supposed to do (215)

V

vacuole membrane-enclosed sac within a cell; is usually large and may be permanent (268)

valence tendency of an atom to gain or lose electrons (36)

valence electron electron in the outermost energy level of an atom (36)

valence number number of electrons an element can gain or lose to combine with other elements (36)

vascular bundle strand of xylem, phloem, and associated tissues in a plant (313)

vascular tissue transport tissue formed of cells joined into tubes that carry water and nutrients through the body of the plant (300)

vector quantity quantity that indicates magnitude and direction (137)

velocity speed and direction of an object (137)

vesicle membrane-enclosed sac that transports materials throughout a cell; structure is similar to a vacuole (268)

volume space, measured in cubic units, occupied or contained by an object (289)

W

weather conditions of temperature, air pressure, cloud cover, precipitation (rain or snow), and humidity that occur at a particular place at a particular time (342)

wind movement of cool air from an area of high atmospheric pressure to an area of low atmospheric pressure (372)

work a measure of the amount of energy transferred from one object to another when an object moves against an opposing force or the speed of an object increases; calculated by multiplying the force acting on an object by the distance the object travels (157)

Workplace Hazardous Materials Information System (WHMIS) system of easy-to-see warning symbols on hazardous materials, designed to help protect people who use hazardous materials at work (8)

X

X-ray crystallography the study of the structure of molecules by means of X-rays, special sensors that analyze patterns of X-ray scattering, and computer technology (264)

xylem tissue vascular tissue that conducts water and minerals from the roots to the leaves in plants (300)

xylem vessel tube, formed of cells that are dead at maturity, that transports water and minerals in plants (300)